

**Treatment, Completion, and Workover (TCW) Discharges  
Joint Industry Project Biomonitoring Report**

prepared for

**AECOM, PO# 118543 - Dianne Naeger**

**Sample ID: JIP Study - [REDACTED]**

**- TCW - 12**

Completion/Cat III CaCl<sub>2</sub>, CaBr<sub>2</sub>

**EE USA Project No.: F-1363-20**

Grab Sample Collected: April 25, 2020 at 1106

Pipe Diameter: 15.75", Discharge Rate: 7,968 bbl/day, Depth Difference: 2031 m

Table 1E - Produced Water Critical Dilution: 0.41% TCW

NPDES Permit No.: GMG290000

**EPA Method 2006, *M. beryllina***

SURVIVAL 48-hour NOEC / LOEC = 6.0% / 18.0% TCW

48-hour LC25 9.64% TCW

48-hour LC50: 13.3% TCW

**EPA Method 2007, *A. bahia***

SURVIVAL 48-hour NOEC / LOEC = 0.1% / 0.3% TCW

48-hour LC25: 0.15% TCW

48-hour LC50: 0.20% TCW

Report Date: May 6, 2020

by

**ENVIRONMENTAL ENTERPRISES USA, INC.**

58485 PEARL ACRES ROAD, SUITE D

SLIDELL, LOUISIANA 70461

(800) 966-2788

*This report contains six pages plus five appendices, A - E. This report must not be reproduced in part, only in whole. The results and conclusions presented in this report apply only to the sample(s) tested.*

*All results should be considered valid unless otherwise noted in the report.*

Michele Ellis

Michele Ellis

Effluents Testing Supervisor

5/7/20

DATE

David L. Daniel

President

QA/QC Officer

5/7/20

DATE

JIP Study - [REDACTED]

- TCW - 12

1 of 6

F-1363-20

ED\_005567\_00000023-00001

**Menidia beryllina ACUTE, STATIC-RENEWAL 48-HOUR DEFINITIVE TEST,**  
**EPA-821-R-02-012: SECTION 9, Method 2006**

**TEST OVERVIEW**

A 48-hour static-renewal toxicity test was conducted by Environmental Enterprises USA, Inc. (EE USA) to determine toxicity of TCW from [REDACTED] to *Menidia beryllina* larvae. Methods, materials, and results are presented in this document. Test organisms were cultured at EE USA and were 13-days-old when this test was initiated. Synthetic seawater at 25 parts per thousand (ppt) salinity was used as the laboratory performance control (LPC) solution and diluent in this test. Five replicates of the LPC and seven TCW concentrations were prepared initially and renewed daily. TCW concentrations tested were 0.1, 0.3, 0.8, 2.0, 6.0, 18.0, and 50.0%. This test was initiated April 29, 2020, at 1540 and completed May 1, 2020, at 1407.

**MATERIALS AND METHODS**

Materials and methods for the work performed are stated in EPA-821-R-02-012: Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Actual materials and methods are detailed below. This test was performed with strict adherence to the requirements of EPA-821-R-02-012, Section 9, Method 2006 and/or the Western Gulf of Mexico OCS General Permit with the following exception(s):

- 1) The critical dilution and dilution series specified by the Western Gulf of Mexico OCS General Permit for produced water discharge were not tested. The TCW concentrations tested were specified by the Joint Industry Project Study Plan for Treatment, Completion, and Workover Discharges.

The recommendations and suggestions made elsewhere in EPA-821-R-02-012 were incorporated whenever applicable to optimize the experimental design. Dilution water was prepared with hw-MARINEMIX + Bio-elements and Crystal Sea Marinemix Bioassay Laboratory Formula sea salts (80:20) and deionized water and adjusted to 25 ppt salinity.

*M. beryllina* was cultured and maintained at 24±1°C and 25 ppt salinity. Several clutches from different females comprised the embryo pool from which test organism population hatched. Prior to test initiation, test organisms were fed a standardized suspension of less than 24-hour-old *Artemia* nauplii twice daily. The standard suspension is equal to 0.05 grams wet weight strained nauplii per ml synthetic seawater. One day prior to test initiation, eight inland silverside minnows were transferred randomly into 40 test chambers with 200 ml synthetic seawater. These test chambers were then placed in the environmental chamber.

Sensitivity of test organisms to a known toxicant was determined by performing an acute 48-hour Standard Reference Toxicant (SRT) test, MN2004-48, with potassium chloride (Fisher Chemical, Lot 181155). The SRT test was initiated on April 8, 2019, with 13-day old *M. beryllina*. The SRT data were used to calculate the 48-hour LC50. Appendix E contains *M. beryllina* SRT control charts.

	SURVIVAL
48-hour LC50:	1430 mg/L
Upper and Lower 95% Confidence Interval:	1350 to 1520 mg/L

The sample used in this test was collected at [REDACTED] on April 25, 2020, and delivered to EE USA on April 27, 2020 (Appendix D). This sample was stored at 0.1 to 6.0°C and used to prepare the initial and subsequent renewal test solutions. Daily, each treatment was weighed in a 4.0 L glass bottle, covered, and mixed for 5 hours on magnetic stirrers using ½" diameter by 3" long stir bars (Appendix A, pages 2 & 3). Test chambers were labeled with test concentration, replicate identification, and EE USA's project number. Eight treatments, seven TCW concentrations and an LPC, were prepared daily (Appendix A, page 1).

After the test solutions reached test temperature, initial water quality parameters (temperature, dissolved oxygen (DO), and salinity) were measured. Alkalinity, salinity, and pH were measured in the LPC April 29 and April 30, 2020. Water quality measurements could not be recorded on the undiluted TCW (Appendix A, page 1 and Appendix D). At the end of each 24-hour exposure period, just prior to renewal, the ending DO, temperature, salinity, and pH in each treatment was recorded (Appendix A, pages 8 & 9).

On Day 0, the preloaded replicate test chambers were removed from the environmental chamber and carefully examined. Dead or injured larvae were replaced with organisms from the same batch and this test was initiated by renewal: excess food and debris was removed by pipette and 90% of the treatment solution was poured out of each replicate. Aliquots of freshly prepared treatments were poured gently into each replicate as appropriate and then this test was placed in the environmental chamber. Surviving test organisms were disturbed as little as possible during renewal. On Day 1, the test was renewed. Every 24 hours, survival was recorded (Appendix A, pages 4 & 5). After 48 hours, the final survival data were recorded and this test was terminated. Test acceptability criteria (TAC) include minimum LPC survival, 90%, and maximum percent coefficient of variation (%CV) in the LPC and critical dilution, 40. This test met all TAC. Survival in the concurrent LPC was 100.0%. The %CV was calculated using the number of surviving *M. beryllina* in each replicate. The highest %CV for lethal effects for the control was 0.00 (Appendix B, page 1).

#### Summary of Experimental Conditions

Test Organisms:	13-day-old <i>Menidia beryllina</i> larvae.
Dilution Water:	Synthetic seawater, 25 ppt salinity.
Temperature:	25±1°C
Photoperiod:	16 hours light; 8 hours dark.
Test Chambers:	Disposable plastic cups, 9 cm in diameter. Total volume = 480 ml.
Test Solution Volume:	200 ml.
Aeration:	No.
Test Solution Renewal:	Yes.

On May 4, 2020, six liters were prepared at the critical dilution, 0.41% TCW, and transferred to analytical sample containers supplied by Element Lafayette. Analytical samples were shipped to Element Lafayette on May 4, 2020 (Appendix A, page 10).

#### RESULTS AND CONCLUSION

The response used in statistical analysis of survival data was the proportion of surviving test organisms per replicate. These proportions were transformed by the Arc Sine Square Root Transformation and then tested for normal distribution and homogeneity of variance using Shapiro-Wilk's and Bartlett's tests, respectively. Survival data were not normally distributed and were further evaluated by the nonparametric alternative, Steel's Many-One Rank Sum Test. The No Observed Effect Concentration (NOEC) for impaired *M. beryllina* survival was 6.0% TCW. The Lowest Observed Effect Concentration (LOEC) was 18.0% TCW (Appendix B, page 1). The minimum statistically significant percent difference (MSDp) between survival in the control and survival at any TCW concentration tested, for this *M. beryllina* survival data set, was 9.13 (Appendix B, page 1).

The 48-hour survival data were analyzed by Linear Interpolation to estimate the 48-hour LC25 and LC50: point estimates of the concentrations expected to result in 25% and 50% mortality, respectively, to *M. beryllina* larvae after 48 hours of exposure. The 48-hour LC25 was 9.64% TCW, with a 95% confidence interval of 8.92 to 11.1% TCW. The 48-hour LC50 was 13.3% TCW, with a 95% confidence interval of 11.8 to 16.2% TCW (Appendix B, page 3). Survival data summary statistics are presented in Appendix B.

**Americamysis bahia ACUTE, STATIC-RENEWAL 48-HOUR DEFINITIVE TEST,**  
**EPA-821-R-02-012: SECTION 9, Method 2007**

**TEST OVERVIEW**

A 48-hour static-renewal toxicity test was conducted by EE USA to determine toxicity of TCW from [REDACTED] to *Americamysis bahia* juveniles. Methods, materials, and results are presented in this document. Test organisms were cultured at EE USA and were 5-days-old when this test was initiated. Synthetic seawater at 25 ppt salinity was used as the LPC solution and diluent in this test. Five replicates of the LPC and seven TCW concentrations were prepared initially and renewed daily. TCW concentrations tested were 0.1, 0.3, 0.8, 2.0, 6.0, 18.0, and 50.0%. This test was initiated April 29, 2020, at 1543 and completed May 1, 2020, at 1413.

**MATERIALS AND METHODS**

Materials and methods for the work performed are stated in EPA-821-R-02-012: Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Actual materials and methods are detailed below. This test was performed with strict adherence to the requirements of EPA-821-R-02-012, Section 9, Method 2007 and/or the Western Gulf of Mexico OCS General Permit with the following exception(s):

- 1) The critical dilution and dilution series specified by the Western Gulf of Mexico OCS General Permit for produced water discharge were not tested. The TCW concentrations tested were specified by the Joint Industry Project Study Plan for Treatment, Completion, and Workover Discharges.

The recommendations and suggestions made elsewhere in EPA-821-R-02-012 were incorporated whenever applicable to optimize the experimental design. Dilution water was prepared with hw-MARINEMIX + Bio-elements and Crystal Sea Marinemix Bioassay Laboratory Formula sea salts (80:20) and deionized water and adjusted to 25 ppt salinity.

*A. bahia* was cultured and maintained at 24±1°C and 25 ppt salinity. Four days before initiating this test, approximately 500, 12- to 24-hour-old mysids were collected from breeding cultures, moved to a holding system, and acclimated to 25±1°C. Test organisms were fed 200 µl of a standardized suspension of less than 24-hour-old *Artemia* nauplii twice daily by replicate. The standard suspension is equal to 0.05 grams wet weight strained nauplii per ml synthetic seawater.

Sensitivity of test organisms to a known toxicant was determined by performing an acute 48-hour Standard Reference Toxicant (SRT) test, AB2004-48, with potassium chloride (Fisher Chemicals, Lot 181155). The SRT test was initiated on April 8, 2019, with 5-day old *A. bahia*. The SRT data were used to calculate the 48-hour LC50. Appendix E contains *A. bahia* SRT control charts.

**SURVIVAL**

48-hour LC50: 658 mg/L

Upper and Lower 95% Confidence Interval: 606 to 714 mg/L

The sample used in this test was collected at [REDACTED] on April 25, 2020, and delivered to EE USA on April 27, 2020 (Appendix D). This sample was stored at 0.1 to 6.0°C and used to prepare the initial and subsequent renewal test solutions. Daily, each treatment was weighed in a 4.0 L glass bottle, covered, and mixed for 5 hours on magnetic stirrers using ½" diameter by 3" long stir bars (Appendix A, pages 2 & 3). Test chambers were labeled with test concentration, replicate identification, and EE USA's project number. Eight treatments, seven TCW concentrations and a LPC, were prepared daily (Appendix A, page 1).

Each treatment was poured into a new acid-washed 1-gallon plastic container and placed in an environmental chamber to warm up to test temperature. After the test solutions reached test temperature, initial water quality parameters (temperature, DO, and salinity) were measured. Alkalinity, salinity, and pH were measured in the LPC April 29 and April 30, 2020 (Appendix A, page 1). Water quality measurements could not be recorded on the undiluted TCW sample (Appendix A, page 1 and Appendix D). At the end of each 24-hour exposure period, just prior to renewal, the ending DO, temperature, salinity, and pH in each treatment was recorded (Appendix A, pages 8 & 9).

On Day 0, the treatments were poured into their respective test chambers, eight *A. bahia* juveniles were distributed randomly to each, and then this test was placed in the environmental chamber. On Day 1, the test was renewed: 90% of the treatment solution, excess food, and debris were poured or siphoned out of each replicate. Aliquots of freshly prepared treatments were poured gently into each replicate as appropriate. Surviving test organisms were disturbed as little as possible during renewal. Every 24 hours, survival was recorded (Appendix A, pages 6 & 7). After 48 hours, the final survival data were recorded and this test was terminated. Test acceptability criteria (TAC) include minimum LPC survival, 90%, and maximum percent coefficient of variation (%CV) in the LPC and critical dilution, 40. This test met all TAC. Survival in the concurrent LPC was 100.0%. The %CV was calculated using the number of surviving *A. bahia* in each replicate. The highest %CV for lethal effects for the control was 0.00 (Appendix C, page 1).

#### Summary of Experimental Conditions

Test Organisms:	5-day-old <i>Americamysis bahia</i> juveniles.
Dilution Water:	Synthetic seawater, 25 ppt salinity.
Temperature:	25±1°C.
Photoperiod:	16 hours light; 8 hours dark.
Test Chambers:	Disposable plastic cups, 9cm in diameter. Total volume = 480 ml.
Test Solution Volume:	200 ml.
Aeration:	No.
Test Solution Renewal:	Yes.

#### RESULTS AND CONCLUSION

The response used in statistical analysis of survival data was the proportion of surviving test organisms per replicate. These proportions were transformed by the Arc Sine Square Root Transformation and then tested for normal distribution and homogeneity of variance using Shapiro-Wilk's and Bartlett's tests, respectively. Survival data were not normally distributed and were further evaluated by the nonparametric alternative, Steel's Many-One Rank Test. The NOEC for impaired *A. bahia* survival was 0.1% TCW. The LOEC was 0.3% TCW (Appendix C, page 1). The MSD<sub>p</sub> between survival in the control and survival at any TCW concentration tested, for this *A. bahia* survival data set, was 5.93 (Appendix C, page 1).

The 48-hour survival data were analyzed by Linear Interpolation to estimate the 48-hour LC25 and LC50: point estimates of the concentrations expected to result in 25% and 50% mortality, respectively, to *A. bahia* juveniles after 48 hours of exposure. The 48-hour LC25 was 0.15% TCW, with a 95% confidence interval of 0.13 to 0.15% TCW. The 48-hour LC50 was 0.20% TCW, with a 95% confidence interval of 0.19 to 0.20% TCW (Appendix C, page 3). Survival data summary statistics are presented in Appendix C.

## REFERENCES

AECOM. Joint Industry Project Study Plan for Treatment, Completion, and Workover Discharges. AECOM, Houston, TX 77094 and Marine Ventures International, Inc., Stuart, FL 34997. August 2019.

EE USA. April 2018. Quality Assurance Plan. EE USA, Slidell, LA 70461.

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Tidepool Scientific Software. 2018. CETIS™ Comprehensive Environmental Toxicity Information System. Version 1.9.6.12. Tidepool Scientific, LLC, McKinley, CA 95519.

U. S. Environmental Protection Agency, March 1983. Methods for Chemical Analysis of Water and Wastes, EPA 600-4-79-020. Office of Research and Development. Washington, DC 20460.

U.S. Environmental Protection Agency. June 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination System Program. EPA 833-R-00-003. Office of Wastewater Management (4203). Washington, DC 20460.

U.S. Environmental Protection Agency. July 2000. Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing (40 CFR Part 136). EPA 821-B-00-004. Office of Water (4303). Washington, DC 20460.

U.S. Environmental Protection Agency. October 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. EPA-821-R-02-012, Method 2006 and Method 2007. 5<sup>th</sup> Edition. Office of Water (4303T). Washington, DC 20460.

U.S. Environmental Protection Agency Region VI, Effective: October 1, 2017. Final NPDES General Permit for New and Existing Sources and New Dischargers in the Offshore Subcategory of the Oil and Gas Extraction Category for the Western Portion of the Outer Continental Shelf of the Gulf of Mexico (GMG290000). FR Volume 82, No. 189: 45845, October 2, 2017.

**Environmental Enterprises USA, Inc.**

**APPENDIX A**

**TCW Fluids Joint Industry Project – AECOM JIP Study –**  
**[REDACTED] – TCW – 12**

Critical Dilution: 0.41% TCW      7,968 bbl/day, 15.75' pipe, 2,031 m

**Test Concentrations, % Treatment Completion or  
Workover Fluid (TCW)**

<i>Menidia beryllina</i>	<i>Americamysis bahia</i>	Total Volume/ Concentration, ml	Color Code	g TCW	ml TCW	ml DH <sub>2</sub> O
50.0		2000.00	Black	911.58	1000.00	1000.00
18.0		"	Red	328.17	360.00	1640.00
6.0		"	Yellow	109.39	120.00	1880.00
2.0		"	Green	36.46	40.00	1960.00
0.8		"	Blue/Green	14.59	16.00	1984.00
0.3		"	Blue	5.47	6.00	1994.00
0.1		"	White/Blue	1.82	2.00	1998.00
0.00		"	White	0.00	0.00	2000.00
Total Volume (ml) of TCW needed per day =						
1544.00						
Total Volume (ml) of TCW needed for test duration =						
3088.00						

See page 2 – 3 for detailed mixing preparations

DH<sub>2</sub>O = Dilution Water = Synthetic Seawater, 25 ppt

Data Pages & Calculations by: Mike Robbins      QA/QC Check by: M. Robbins  
*M. beryllina* = 5 Reps x 200 ml      *A. bahia* = 5 Reps x 200 ml  
= 1000 ml      = 1000 ml

	LPC	M #	LPC	M #	TCW #1	M #
Date	04/29		04/30		04/29	
Alkalinity	94.45	//	100	//	(A)	//
Salinity	25.2	18	25.1	18	(A)	
pH	7.9	3N	8.0	3N	(A)	
	ME		ME			

(A) Data could not  
be measured on  
raw sample 0429;

LPC: Laboratory Performance Control, synthetic seawater; Alkalinity (EPA Method 310.2): mg/L as CaCO<sub>3</sub>; Salinity (EPA Method 120.1): ppt; pH (EPA Method 150.1): su; M#: meter number  
Dissolved Oxygen, Electrode (EPA Method 360.1): mg/L; Temperature, Thermometric (EPA Method 170.1): °C

Prep Date	04/29/20		04/30/20	
DH <sub>2</sub> O Lot #	25R-	117	-20	25R- 118 -20
Sample #		1		1
pH	N/A		N/A	
M #	—		—	
Initial	ME		ME	

F-1363-20  
NOEC/LOEC & ICP

**TCW Fluids Joint Industry Project – AECOM JIP Study –**  
**[REDACTED] – TCW – 12**

Measured Density: 1.097mg/L  
 Measured by: LOEFT Scale ID: 3B Date: 4-29-20 Time: 09:00  
ME error  
040920mL

**Mixing Preparation - 04/29/20**

Concentraions %	Weight g	Scale ID	Init.	Speed & Stir Plate ID	Start Time	Init.	End Time	Init.
LPC	N/A	/	ME	320 15	1020	ME	1520	ME
0.1	1.83	4S	ME	320 1H	1020	ME	1520	ME
0.3	5.48	4S	ME	320 1K	1020	ME	1520	ME
0.8	14.59	4S	ME	320 3F	1020	ME	1520	ME
2.0	36.45	4S	ME	320 A74	1020	ME	1520	ME
6.0	109.37	4S	ME	320 A100	1020	ME	1520	ME
18.0	328.15	4S	ME	320 A71	1020	ME	1520	ME
50.0	911.51	4S	ME	320 3H	1020	ME	1520	ME

**TCW Fluids Joint Industry Project – AECOM JIP Study –**  
**TCW – 12**

**Mixing Preparation - 04/30/20**

Concentrations %	Weight g	Scale ID	Init.	Speed & Stir Plate ID	Start Time	Init.	End Time	Init.
LPC	N/A	/	ME	320 1H	0920	ME	1422	ME
0.1	1.83	4S	ME	320 1K	0920	ME	1422	ME
0.3	54.7	4S	ME	320 3F	0920	ME	1422	ME
0.8	145.7	4S	ME	320 1J	0920	ME	1422	ME
2.0	360.45	4S	ME	320 A74	0920	ME	1422	ME
6.0	109.38	4S	ME	320 A71	0920	ME	1422	ME
18.0	328.16	4S	ME	320 A100	0920	ME	1422	ME
50.0					(A) 0920	ME		

(All wrong data  
043020ME)

**Inlandsilverside Minnow, *Menidia beryllina***

Acute Static-Renewal 48 – Hour Definitive Test

EPA-821-R-02-012: Section 9 Method 2006

**TCW Fluids Joint Industry Project – AECOM JIP Study –  
[REDACTED] TCW – 12**

Critical Dilution: 0.41% TCW      7,968 bbl/day, 15.75" pipe, 2,031 m

Test Organisms Age: 13 Days Old      Test Organisms Source: EE  
 Test Initiation At: IS40 on 4/29/20  
 Counted by: SM QC/QA by: SM Loaded by: SM  
 Organism Lot # SMN-107-20

Exposure Chamber: 16 oz. plastic cups. Feeding: 200 µl 2X / day / replicate.

**Survival Data, 0 Hour**

Treatment % TCW	R E P	Survival	Initials/ Time								
LPC	1	8	2	8	3	8	4	8	5	8	04/29/20
0.1	6	8	7	8	8	8	9	8	10	8	0 HR
0.3	11	8	12	8	13	8	14	8	15	8	SM
0.8	16	8	17	8	18	8	19	8	20	8	
2.0	21	8	22	8	23	8	24	8	25	8	
6.0	26	8	27	8	28	8	29	8	30	8	
18.0	31	8	32	8	33	8	34	8	35	8	
50.0	36	8	37	8	38	8	39	8	40	8	

**Survival Data, 24 Hour**

Treatment % TCW	R E P	Survival	Initials/ Time								
LPC	1	8	2	8	3	8	4	8	5	8	04/30/20
0.1	6	8	7	8	8	8	9	8	10	8	24 HR
0.3	11	8	12	8	13	8	14	8	15	8	SM
0.8	16	8	17	8	18	8	19	8	20	8	
2.0	21	8	22	8	23	8	24	8	25	8	
6.0	26	8	27	8	28	8	29	8	30	8	
18.0	31	8	32	8	33	7	34	7	35	8	
50.0	36	0	37	0	38	0	39	0	40	0	

F-1363-20  
NOEC/LOEC & ICp

Inlandsilverside Minnow, *Menidia beryllina*

## Survival Data, 48 Hour

Treatment % TCW	R E P	Survival	Initials/ Time								
LPC	1	8	2	8	3	8	4	8	5	8	
0.1	6	8	7	8	8	8	9	8	10	8	05/01/20 48 HR
0.3	11	8	12	8	13	8	14	8	15	8	MH
0.8	16	8	17	8	18	8	19	8	20	8	
2.0	21	8	22	8	23	8	24	8	25	8	
6.0	26	8	27	8	28	8	29	8	30	8	
18.0	31	1	32	1	33	D	34	1	35	4	
50.0	36	0	37	D	38	D	39	D	40	0	

Data Entry by: MH QA/QC Officer: JW

**Mysid, *Americamysis bahia***  
 Acute Static-Renewal 48 – Hour Definitive Test  
 EPA-821-R-02-012: Section 9 Method 2007

**TCW Fluids Joint Industry Project – AECOM JIP Study –**  
**TCW – 12**

Critical Dilution: 0.41% TCW      7,968 bbl/day, 15.75" pipe, 2,031 m

Test Organisms Age: 5 Days Old      Test Organisms Source: EE  
 Test Initiation At: 1543 on 04/29/20  
 Counted by: CM QC/QA by: SN Loaded by: SN  
 Organism Lot # Ab-203-20

Exposure Chamber: 16 oz. plastic cups. Feeding: 200 µl 2X / day / replicate.

**Survival Data, 0 Hour**

Treatment % TCW	R E P	Survival	Initials/ Time								
LPC	1	8	2	8	3	8	4	8	5	8	<u>04/29/20</u> <u>0 HR</u> <u>SN</u> <u>1543</u>
0.1	6	8	7	8	8	8	9	8	10	8	
0.3	11	8	12	8	13	8	14	8	15	8	
0.8	16	8	17	8	18	8	19	8	20	8	
2.0	21	8	22	8	23	8	24	8	25	8	
6.0	26	8	27	8	28	8	29	8	30	8	
18.0	31	8	32	8	33	8	34	8	35	8	
50.0	36	8	37	8	38	8	39	8	40	8	

**Survival Data, 24 Hour**

Treatment % TCW	R E P	Survival	Initials/ Time								
LPC	1	8	2	8	3	8	4	8	5	8	<u>04/30/20</u> <u>24 HR</u> <u>MM</u> <u>1451</u>
0.1	6	8	7	7	8	8	9	8	10	8	
0.3	11	7	12	6	13	8	14	7	15	6	
0.8	16	7	17	5	18	7	19	8	20	8	
2.0	21	7	22	6	23	7	24	7	25	8	
6.0	26	7	27	7	28	5	29	6	30	5	
18.0	31	0	32	0	33	0	34	0	35	0	
50.0	36	0	37	0	38	0	39	0	40	0	

*Mysid, Americamysis bahia*

## Survival Data, 48 Hour

Treatment % TCW	R E P	Survival	Initials/ Time								
LPC	1	8	2	8	3	8	4	8	5	8	
0.1	6	8	7	7	8	8	9	8	10	8	05/01/20 48 HR
0.3	11	0	12	0	13	0	14	0	15	0	Mh
0.8	16	0	17	0	18	0	19	0	20	0	
2.0	21	0	22	0	23	0	24	0	25	0	14/13
6.0	26	0	27	0	28	0	29	0	30	0	
18.0	31	0	32	0	33	0	34	0	35	0	
50.0	36	0	37	0	38	0	39	0	40	0	

Data Entry by: M QA/QC Officer: DuJ

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### Water Quality Data

**All Treatments:** Temp., 23.5 to 26.4°C. Initial & Final Dissolved Oxygen (DO): 4.0 to 7.5 mg/L  
**LPC:** Initial Salinity, 24.5 to 25.4 ppt. I: initial water quality. F: final water quality.

Initial, <i>M. beryllina</i> & <i>A. bahia</i>										
0 HR	Treatment % TCW									
	04/29/20	LPC	0.1	0.3	0.8	2.0	6.0	18.0	50.0	Meter #
DO	7.0	7.0	7.1	7.0	7.0	7.1	7.2	7.5	57	
Temp	25.8	25.8	26.0	26.0	26.1	26.0	25.0	24.1	1B	
Salinity	25.2	25.1	25.2	25.5	26.0	27.0	32.9	44.3	1B	
Tech Initials:	NM				Time: 1528					

Final, <i>M. beryllina</i>										
24 HR	Treatment % TCW									
	04/30/20	LPC	0.1	0.3	0.8	2.0	6.0	18.0	50.0	Meter #
DO	5.8	5.9	5.7	5.7	5.8	5.3	4.2	5.0	57	
Temp	25.8	25.8	25.6	25.7	25.4	25.7	25.8	25.8	1B	
Salinity	25.2	25.2	25.2	25.5	26.1	27.4	32.1	40.9	1B	
pH	7.7	7.7	7.7	7.8	8.1	8.2	8.5	8.7	3N	
Tech Initials:	CM				Time: 0853					

Final, <i>A. bahia</i>										
24 HR	Treatment % TCW									
	04/30/20	LPC	0.1	0.3	0.8	2.0	6.0	18.0	50.0	Meter #
DO	4.5	4.7	4.4	4.3	4.1	4.2	4.9	4.9	57	
Temp	25.7	25.2	25.7	25.9	25.8	25.8	25.8	26.0	1B	
Salinity	25.2	25.4	25.3	25.5	26.1	27.7	32.7	43.9	1B	
pH	7.4	7.5	7.5	7.6	7.8	8.2	8.5	8.6	3N	
Tech Initials:	CM				Time: 0853					

DO: mg/L pH: su Salinity: ppt Temp: °C

## Water Qualiy Data

All Treatments: Temp., 23.5 to 26.4°C. Initial & Final Dissolved Oxygen (DO): 4.0 to 7.5 mg/L.  
 LPC: Initial Salinity, 24.5 to 25.4 ppt. I: initial water quality. F: final water quality.

Initial, <i>M. beryllina</i> & <i>A. bahia</i>									
24 HR	Treatment % TCW								
04/30/20	LPC	0.1	0.3	0.8	2.0	6.0	18.0	50.0	Meter #
DO	7.0	7.0	7.0	6.9	6.9	7.0	7.0		57
Temp	26.2	25.8	25.8	25.9	25.9	25.8	25.3		1B
Salinity	25.1	25.1	25.2	25.3	25.9	27.6	32.8		1B
Tech Initials:	ME				Time: 1423				

Final, <i>M. beryllina</i>									
48 HR	Treatment % TCW								
05/01/20	LPC	0.1	0.3	0.8	2.0	6.0	18.0	50.0	Meter #
DO	10.3	10.3	10.1	10.1	5.8	5.5	4.1		57
Temp	24.7	24.9	24.9	25.0	25.4	25.8	25.10		1B
Salinity	25.2	25.2	25.3	25.5	26.1	27.8	31.0		1B
pH	7.8	7.8	7.9	7.9	8.0	8.2	8.5		3N
Tech Initials:	SM				Time: 0855				

Final, <i>A. bahia</i>									
48 HR	Treatment % TCW								
05/01/20	LPC	0.1	0.3	0.8	2.0	6.0	18.0	50.0	Meter #
DO	5.8	5.9	5.7	5.10	5.5	5.1			57
Temp	25.5	28.5	28.5	28.10	28.10	28.7	28.5		1B
Salinity	25.2	25.3	25.3	25.4	25.5	27.7			1B
pH	7.7	7.7	7.7	7.10	7.80	8.3			3N
Tech Initials:	SM				Time: 0851				

DO: mg/L pH: su Salinity: ppt Temp: °C

@ remeasured 5-1-20 SM

**TCW Fluids Joint Industry Project – AECOM JIP Study –**  
**[REDACTED] – TCW – 12**

**Feeding Chart**

<i>Artemia</i> Lot #	
072519-1	
Initial	ME

*M. beryllina* – not fed.

***A. bahia***

AM				PM			
Date	Amount, $\mu$ l	Time	Initials	Date	Amount, $\mu$ l	Time	Initials
				04/29/20	200	1551	SM
04/30/20	200	1017	ME	04/30/20	200	1454	ME
05/01/20	200	0814	ME				

**ANALYTICAL SAMPLE PREPARATION**

Prepare 6 L in SSW at 0.41% TCW.

24.6 ml TCW + 5975.4 ml SSW.  
(22.42g)

Fill Element Analytical Sample Containers and store in Refrigerator.

Prepared by: ME Time: 1305 Date: 5/4/20

Samples will be shipped Fed Express 5/4/20 to arrive at  
Element 5-5-20.

Federal Express Tracking Number: 813229462808 +  
815796453634

F-1363-20  
NOEC/LOEC & ICp

**Data Pages**

- Company name & contact matches client file.  
 Area and block matches client file.  
 Flow data & critical dilution (CD) match client file; and dilution series are correct:

7968 bbl/day, 15.5" pipe, .031 m, 0.41 % (CD)

Dilution series: (CD is 3<sup>rd</sup> dilution in series)

0.1, 0.3, 0.8, 2.0, 6.0, 18.0, 50.0

- Calculations on mixing page are correct. (sign mixing page)  
 Dates, dilutions, test method, # of replicates, replicate volume, area & block, acceptance limits, data analysis endpoint, and test organisms are correct throughout data pages.  
 Format correct. (spaces for all entries, page numeration, no split pages, etc.)

ME

Initials

4/29/20

Date

---

**Chain-of-Custody**

- Area and block on COC matches sample bottle.  
 Area and block on COC matches test data pages.  
 Lab # on COC matches sample bottle.  
 Lab # on COC matches test data pages.  
 Sample collection date: 4/26/20 & Time: 1100 hrs.  
 expiration date: 4/26/20 & Time: 1300 hrs. (Sample expired if >36 hrs)  
 Sample volume is sufficient for test duration. (Sample volume in container(s) checked against sample volume on mixing page)

Sample volume available: 4000 ml

Sample volume needed: 3088 ml

(Sample volume insufficient if sample volume available < sample volume needed)

ME

Initials

4/29/20

Date

---

**Jugs & Labels**

- Lab # on jug and labels matches test data pages.  
 Dilution water type is on jug. (i.e. 25 ppt, 20 ppt, MHSF, etc.)  
 Dilutions on jugs and labels match dilutions on test data pages.  
 Jugs are color-coded. (see mixing page for appropriate color code sequence)

ME

Initials

4/29/20

Date

Raw Data QC/QA by: Michael Ellis 5/4/20

**Environmental Enterprises USA, Inc.**

**APPENDIX B**

# CETIS Analytical Report

Report Date: 05 May-20 08:32 (p 1 of 2)  
 Test Code/ID: mn136320 / 10-8296-4809

## Inland Silverside Acute Survival Test

Environmental Enterprises USA, Inc.

Analysis ID: 10-7346-2211	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.9.6			
Analyzed: 05 May-20 8:32	Analysis: Nonparametric-Control vs Treatments	Status Level: 1			
Data Transform	Alt Hyp	NOEL			
Angular (Corrected)	G > T	6	LOEL	TU	PMSD

## Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision( $\alpha:5\%$ )
Control	0.1	27.5	16	1	8	CDF	0.8571	Non-Significant Effect	
	0.3	27.5	16	1	8	CDF	0.8571	Non-Significant Effect	
	0.8	27.5	16	1	8	CDF	0.8571	Non-Significant Effect	
	2	27.5	16	1	8	CDF	0.8571	Non-Significant Effect	
	6	27.5	16	1	8	CDF	0.8571	Non-Significant Effect	
	18*	15	16	0	8	CDF	0.0222	Significant Effect	

## Test Acceptability Criteria

### TAC Limits

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	1	0.9	>>	Yes	Passes Criteria

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision( $\alpha:5\%$ )
Between	4.14666	0.691111	6	95.81	<1.0E-37	Significant Effect
Error	0.201976	0.0072134	28			
Total	4.34864		34			

## ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision( $\alpha:1\%$ )
Variance Distribution	Bartlett Equality of Variance Test Shapiro-Wilk W Normality Test	0.3794	0.9146	5.0E-11	Indeterminate Non-Normal Distribution

## 48h Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	LP	5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
0.1		5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
0.3		5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
0.8		5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
2		5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
6		5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
18		5	0.1750	0.0000	0.4104	0.1250	0.0000	0.5000	0.0848	108.33%	82.50%
50		5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%

## Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	LP	5	1.393	1.393	1.393	1.393	1.393	1.393	0	0.00%	0.00%
0.1		5	1.393	1.393	1.393	1.393	1.393	1.393	0	0.00%	0.00%
0.3		5	1.393	1.393	1.393	1.393	1.393	1.393	0	0.00%	0.00%
0.8		5	1.393	1.393	1.393	1.393	1.393	1.393	0	0.00%	0.00%
2		5	1.393	1.393	1.393	1.393	1.393	1.393	0	0.00%	0.00%
6		5	1.393	1.393	1.393	1.393	1.393	1.393	0	0.00%	0.00%
18		5	0.4094	0.1304	0.6885	0.3614	0.1777	0.7854	0.1005	54.88%	70.61%
50		5	0.1777	0.1777	0.1778	0.1777	0.1777	0.1777	0	0.00%	87.24%

## CETIS Analytical Report

Report Date: 05 May-20 08:32 (p 2 of 2)  
 Test Code/ID: mn136320 / 10-8296-4809

## Inland Silverside Acute Survival Test

Environmental Enterprises USA, Inc.

Analysis ID: 10-7346-2211  
 Analyzed: 05 May-20 8:32

Endpoint: 48h Survival Rate  
 Analysis: Nonparametric-Control vs Treatments

CETIS Version: CETISv1.9.6  
 Status Level: 1

## 48h Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	LP	1.0000	1.0000	1.0000	1.0000	1.0000
0.1		1.0000	1.0000	1.0000	1.0000	1.0000
0.3		1.0000	1.0000	1.0000	1.0000	1.0000
0.8		1.0000	1.0000	1.0000	1.0000	1.0000
2		1.0000	1.0000	1.0000	1.0000	1.0000
6		1.0000	1.0000	1.0000	1.0000	1.0000
18		0.1250	0.1250	0.0000	0.1250	0.5000
50		0.0000	0.0000	0.0000	0.0000	0.0000

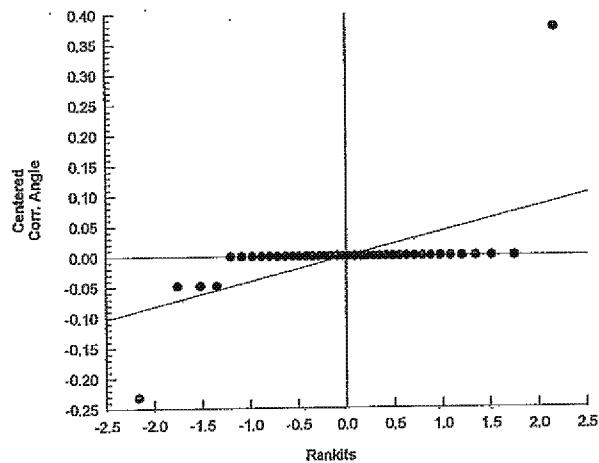
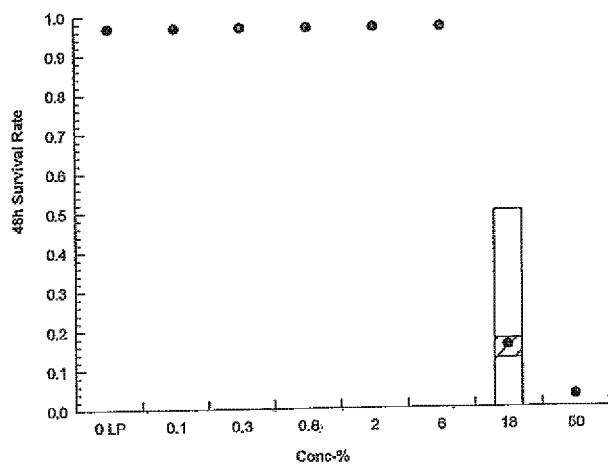
## Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	LP	1.393	1.393	1.393	1.393	1.393
0.1		1.393	1.393	1.393	1.393	1.393
0.3		1.393	1.393	1.393	1.393	1.393
0.8		1.393	1.393	1.393	1.393	1.393
2		1.393	1.393	1.393	1.393	1.393
6		1.393	1.393	1.393	1.393	1.393
18		0.3614	0.3614	0.1777	0.3614	0.7854
50		0.1777	0.1777	0.1777	0.1777	0.1777

## 48h Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	LP	8/8	8/8	8/8	8/8	8/8
0.1		8/8	8/8	8/8	8/8	8/8
0.3		8/8	8/8	8/8	8/8	8/8
0.8		8/8	8/8	8/8	8/8	8/8
2		8/8	8/8	8/8	8/8	8/8
6		8/8	8/8	8/8	8/8	8/8
18		1/8	1/8	0/8	1/8	4/8
50		0/8	0/8	0/8	0/8	0/8

## Graphics



# CETIS Analytical Report

Report Date: 05 May-20 08:33 (p 1 of 2)  
 Test Code/ID: mn136320 / 10-8296-4809

## Inland Silverside Acute Survival Test

Environmental Enterprises USA, Inc.

Analysis ID: 17-2545-1640      Endpoint: 48h Survival Rate  
 Analyzed: 05 May-20 8:32      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.6  
 Status Level: 1

### Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	2064916	1000	Yes	Two-Point Interpolation

### Test Acceptability Criteria

Attribute	Test Stat	TAC Limits		Overlap	Decision
		Lower	Upper		
Control Resp	1	0.9	>>	Yes	Passes Criteria

### Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC5	6.727	6.584	7.021	14.86	14.24	15.19
LC10	7.455	7.167	8.042	13.41	12.43	13.95
LC15	8.182	7.751	9.063	12.22	11.03	12.9
LC20	8.909	8.335	10.08	11.22	9.917	12
LC25	9.636	8.919	11.1	10.38	9.005	11.21
LC40	11.82	10.67	14.17	8.462	7.058	9.372
LC50	13.27	11.84	16.21	7.534	6.169	8.448

### 48h Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)					Isotonic Variate			
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	LP	5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
0.1		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
0.3		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
0.8		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
2		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
6		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
18		5	0.1750	0.0000	0.5000	0.1896	108.30%	82.5%	7/40	0.175	82.5%
50		5	0.0000	0.0000	0.0000	0.0000		100.0%	0/40	0	100.0%

### 48h Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	LP	1.0000	1.0000	1.0000	1.0000	1.0000
0.1		1.0000	1.0000	1.0000	1.0000	1.0000
0.3		1.0000	1.0000	1.0000	1.0000	1.0000
0.8		1.0000	1.0000	1.0000	1.0000	1.0000
2		1.0000	1.0000	1.0000	1.0000	1.0000
6		1.0000	1.0000	1.0000	1.0000	1.0000
18		0.1250	0.1250	0.0000	0.1250	0.5000
50		0.0000	0.0000	0.0000	0.0000	0.0000

### 48h Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	LP	8/8	8/8	8/8	8/8	8/8
0.1		8/8	8/8	8/8	8/8	8/8
0.3		8/8	8/8	8/8	8/8	8/8
0.8		8/8	8/8	8/8	8/8	8/8
2		8/8	8/8	8/8	8/8	8/8
6		8/8	8/8	8/8	8/8	8/8
18		1/8	1/8	0/8	1/8	4/8
50		0/8	0/8	0/8	0/8	0/8

**CETIS Analytical Report**

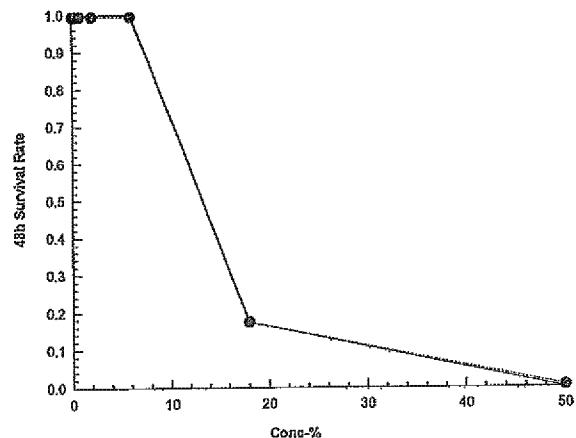
Report Date: 05 May-20 08:33 (p 2 of 2)  
Test Code/ID: mn136320 / 10-8296-4809

**Inland Silverside Acute Survival Test**

Environmental Enterprises USA, Inc.

Analysis ID: 17-2545-1640      Endpoint: 48h Survival Rate  
Analyzed: 05 May-20 8:32      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.6  
Status Level: 1

**Graphics**

**Environmental Enterprises USA, Inc.**

**APPENDIX C**

## CETIS Analytical Report

Report Date: 05 May-20 08:34 (p 1 of 2)  
 Test Code/ID: ab136320 / 03-8494-0536

Americamysis Acute Survival Test								Environmental Enterprises USA, Inc.						
Analysis ID: 14-8653-0174	Endpoint: 48h Survival Rate					CETIS Version: CETISv1.9.6								
Analyzed: 05 May-20 8:34	Analysis: Nonparametric-Control vs Treatments					Status Level: 1								
Data Transform	Alt Hyp					Comparison Result	PMSD							
Angular (Corrected)	C > T					0.1% passed 48h survival rate	5.93%							
Steel Many-One Rank Sum Test														
Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision( $\alpha:5\%$ )					
Control		0.1	25	19	1	8	CDF	0.3008	Non-Significant Effect					
Test Acceptability Criteria				TAC Limits										
Attribute	Test Stat	Lower	Upper	Overlap	Decision									
Control Resp	1	0.9	>>	Yes	Passes Criteria									
ANOVA Table														
Source	Sum Squares		Mean Square		DF	F Stat		P-Value	Decision( $\alpha:5\%$ )					
Between	0.003373		0.003373		1	1		0.3466	Non-Significant Effect					
Error	0.0269838		0.003373		8									
Total	0.0303567				9									
ANOVA Assumptions Tests														
Attribute	Test				Test Stat	Critical	P-Value	Decision( $\alpha:1\%$ )						
Variance	Variance Ratio F Test										Indeterminate			
Distribution	Shapiro-Wilk W Normality Test				0.6247	0.7411	1.1E-04	Non-Normal Distribution						
48h Survival Rate Summary														
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect			
0	LP	5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%			
0.1		5	0.9750	0.9056	1.0000	1.0000	0.8750	1.0000	0.0250	5.73%	2.50%			
0.3		5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%			
0.8		5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%			
2		5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%			
6		5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%			
18		5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%			
50		5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%			
Angular (Corrected) Transformed Summary														
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect			
0	LP	5	1.393	1.393	1.393	1.393	1.393	1.393	0	0.00%	0.00%			
0.1		5	1.356	1.254	1.458	1.393	1.209	1.393	0.03673	6.06%	2.64%			
0.3		5	0.1777	0.1777	0.1778	0.1777	0.1777	0.1777	0	0.00%	87.24%			
0.8		5	0.1777	0.1777	0.1778	0.1777	0.1777	0.1777	0	0.00%	87.24%			
2		5	0.1777	0.1777	0.1778	0.1777	0.1777	0.1777	0	0.00%	87.24%			
6		5	0.1777	0.1777	0.1778	0.1777	0.1777	0.1777	0	0.00%	87.24%			
18		5	0.1777	0.1777	0.1778	0.1777	0.1777	0.1777	0	0.00%	87.24%			
50		5	0.1777	0.1777	0.1778	0.1777	0.1777	0.1777	0	0.00%	87.24%			
48h Survival Rate Detail														
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5								
0	LP	1.0000	1.0000	1.0000	1.0000	1.0000								
0.1		1.0000	0.8750	1.0000	1.0000	1.0000								
0.3		0.0000	0.0000	0.0000	0.0000	0.0000								
0.8		0.0000	0.0000	0.0000	0.0000	0.0000								
2		0.0000	0.0000	0.0000	0.0000	0.0000								
6		0.0000	0.0000	0.0000	0.0000	0.0000								
18		0.0000	0.0000	0.0000	0.0000	0.0000								
50		0.0000	0.0000	0.0000	0.0000	0.0000								

**CETIS Analytical Report**Report Date: 05 May-20 08:34 (p 2 of 2)  
Test Code/ID: ab136320 / 03-8494-0536**Americamysis Acute Survival Test**

Environmental Enterprises USA, Inc.

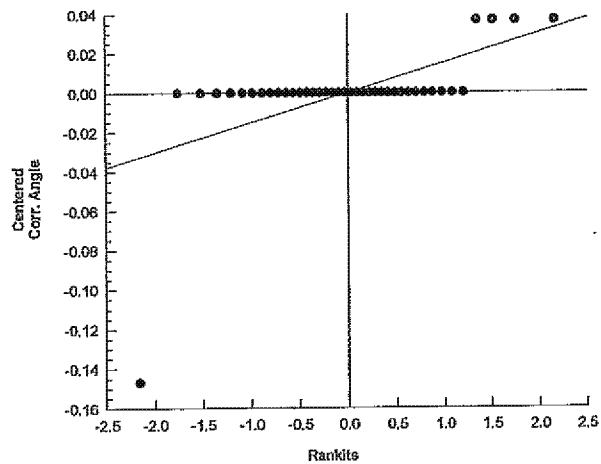
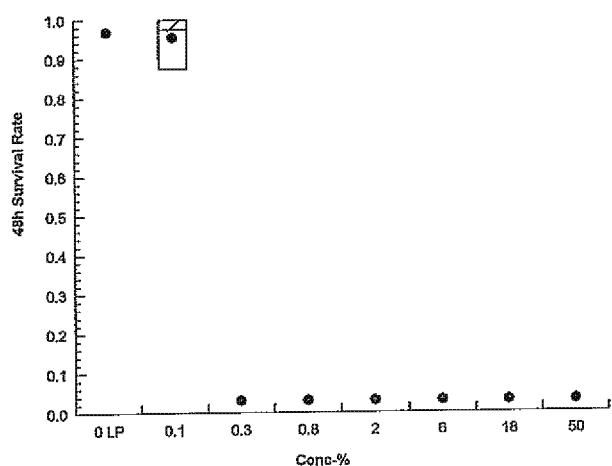
Analysis ID: 14-8653-0174	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.9.6
Analyzed: 05 May-20 8:34	Analysis: Nonparametric-Control vs Treatments	Status Level: 1

**Angular (Corrected) Transformed Detail**

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	LP	1.393	1.393	1.393	1.393	1.393
0.1		1.393	1.209	1.393	1.393	1.393
0.3		0.1777	0.1777	0.1777	0.1777	0.1777
0.8		0.1777	0.1777	0.1777	0.1777	0.1777
2		0.1777	0.1777	0.1777	0.1777	0.1777
6		0.1777	0.1777	0.1777	0.1777	0.1777
18		0.1777	0.1777	0.1777	0.1777	0.1777
50		0.1777	0.1777	0.1777	0.1777	0.1777

**48h Survival Rate Binomials**

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	LP	8/8	8/8	8/8	8/8	8/8
0.1		8/8	7/8	8/8	8/8	8/8
0.3		0/8	0/8	0/8	0/8	0/8
0.8		0/8	0/8	0/8	0/8	0/8
2		0/8	0/8	0/8	0/8	0/8
6		0/8	0/8	0/8	0/8	0/8
18		0/8	0/8	0/8	0/8	0/8
50		0/8	0/8	0/8	0/8	0/8

**Graphics**

## CETIS Analytical Report

Report Date: 05 May-20 08:34 (p 1 of 2)  
 Test Code/ID: ab136320 / 03-8494-0536

Americamysis Acute Survival Test							Environmental Enterprises USA, Inc.												
Analysis ID: 18-7859-9409 Analyzed: 05 May-20 08:34	Endpoint: 48h Survival Rate Analysis: Linear Interpolation (ICPIN)					CETIS Version: CETISv1.9.6													
<b>Linear Interpolation Options</b>																			
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method														
Linear	Linear	1893180	1000	Yes	Two-Point Interpolation														
<b>Test Acceptability Criteria</b>																			
TAC Limits																			
Attribute	Test Stat	Lower	Upper	Overlap	Decision														
Control Resp	1	0.9	>>	Yes	Passes Criteria														
<b>Point Estimates</b>																			
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL													
LC5	0.1051	0.04744	0.1124	951.2	889.4	2108													
LC10	0.1154	0.1004	0.1223	866.7	817.6	995.9													
LC15	0.1256	0.1115	0.1322	795.9	756.5	896.8													
LC20	0.1359	0.1226	0.1421	735.8	704	815.7													
LC25	0.1462	0.1337	0.1519	684.2	658.2	748.1													
LC40	0.1769	0.1669	0.1815	565.2	550.8	599													
LC50	0.1974	0.1891	0.2013	506.5	496.8	528.8													
<b>48h Survival Rate Summary</b>																			
Calculated Variate(A/B) Isotonic Variate																			
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect								
0	LP	5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%								
0.1		5	0.9750	0.8750	1.0000	0.0559	5.73%	2.5%	39/40	0.975	2.5%								
0.3		5	0.0000	0.0000	0.0000	0.0000		100.0%	0/40	0	100.0%								
0.8		5	0.0000	0.0000	0.0000	0.0000		100.0%	0/40	0	100.0%								
2		5	0.0000	0.0000	0.0000	0.0000		100.0%	0/40	0	100.0%								
6		5	0.0000	0.0000	0.0000	0.0000		100.0%	0/40	0	100.0%								
18		5	0.0000	0.0000	0.0000	0.0000		100.0%	0/40	0	100.0%								
50		5	0.0000	0.0000	0.0000	0.0000		100.0%	0/40	0	100.0%								
<b>48h Survival Rate Detail</b>																			
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5													
0	LP	1.0000	1.0000	1.0000	1.0000	1.0000													
0.1		1.0000	0.8750	1.0000	1.0000	1.0000													
0.3		0.0000	0.0000	0.0000	0.0000	0.0000													
0.8		0.0000	0.0000	0.0000	0.0000	0.0000													
2		0.0000	0.0000	0.0000	0.0000	0.0000													
6		0.0000	0.0000	0.0000	0.0000	0.0000													
18		0.0000	0.0000	0.0000	0.0000	0.0000													
50		0.0000	0.0000	0.0000	0.0000	0.0000													
<b>48h Survival Rate Binomials</b>																			
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5													
0	LP	8/8	8/8	8/8	8/8	8/8													
0.1		8/8	7/8	8/8	8/8	8/8													
0.3		0/8	0/8	0/8	0/8	0/8													
0.8		0/8	0/8	0/8	0/8	0/8													
2		0/8	0/8	0/8	0/8	0/8													
6		0/8	0/8	0/8	0/8	0/8													
18		0/8	0/8	0/8	0/8	0/8													
50		0/8	0/8	0/8	0/8	0/8													

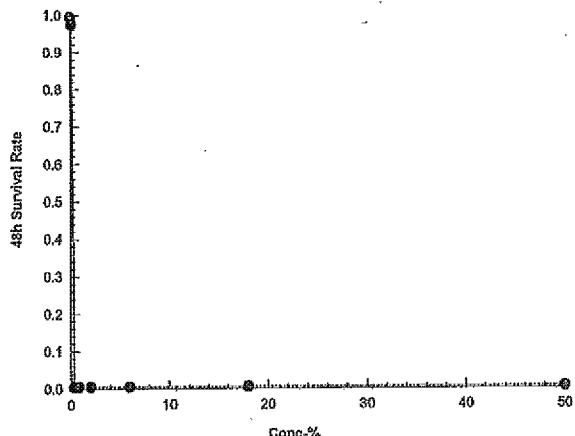
**CETIS Analytical Report**

Report Date: 05 May-20 08:34 (p 2 of 2)  
Test Code/ID: ab136320 / 03-8494-0536

**Americamysis Acute Survival Test****Environmental Enterprises USA, Inc.**

Analysis ID: 18-7859-9409      Endpoint: 48h Survival Rate  
Analyzed: 05 May-20 8:34      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.6  
Status Level: 1

**Graphics**

**Environmental Enterprises USA, Inc.**

**APPENDIX D**

## ENVIRONMENTAL ENTERPRISES USA, INC.

58485 Pearl Acres Rd., Suite D  
Slidell, LA 70461

TEL: (985) 646-2787; FAX: (985) 646-2810

## JIP STUDY - OFF CUSTODY RECORD

SR No.: SR-//0400-30-EW  
4-30-20

Client must fill in shaded area

## Client:

## Address:

## Contact Person:

## Phone#:

## Email#:

## PO Release#:

## Comments: Completion/Cat III CaCl2, CaB12

## JIP Study Treatment, Completion, and Workover (TCW) Discharge

SAMPLE ID#	Date Collected	Time Collected	Duration of Discharge Start Time	Duration of Discharge End Time	Analysis Request	Grab at Start of Discharge	No. of Containers	Waste Type	Preservation	Lab No.
JIP Study - TCW	4/25/20	11:05 - 11:10			M. beryllina (Method 2006) & A. batisia (Method 2007) acute	X	1	TCW	ICE	F-1363-20
					*If known at time of collection					
Discharge Volume/Duration of Discharge (bbl):					498					
Rope Diameter (inches):										
Depth Difference: Discharge Pipe and Seafloor (meters):										
Collected By: Print:					4/27/20 11:06	Relinquished By:  Print:  Sign: 	Date/ Time: 4/27/20 08:00	Date/ Time: -	Date/ Time: 4/27/20 08:00	Date/ Time: -
Received By: Print:						Relinquished By:  Print:  Sign: 	Date/ Time: -	Date/ Time: -	Date/ Time: -	Date/ Time: -
Received By: Print: Company Name E					4/27/20 14:10	Relinquished By:  Print:  Sign: 	Date/ Time: 4/27/20 14:10	Date/ Time: -	Date/ Time: 4/27/20 14:10	Date/ Time: -
Received By: Print: Company Name E						Relinquished By:  Print:  Sign: 	Date/ Time: -	Date/ Time: -	Date/ Time: -	Date/ Time: -
Received By: Print: Company Name E						Relinquished By:  Print:  Sign: 	Date/ Time: -	Date/ Time: -	Date/ Time: -	Date/ Time: -
Received By: Print: Company Name E						Relinquished By:  Print:  Sign: 	Date/ Time: -	Date/ Time: -	Date/ Time: -	Date/ Time: -
EE USA use only! Data recorded by:						Date/Time:				Courier Tracking #:
Sample Data: pH ( ), Temp. ( ), Alkalinity ( ), mg/l CaCO <sub>3</sub> , Salinity ( ), ppt ( ), Gel, mud color ( ), Sample Container(s), Plastic ( ) or										
Lab Comments / Notes: 4/27/20 14:10 ER. Gel, mud color ( ), Sample Container(s), Plastic ( ) or										
Notes: ① Data could not be recorded on ② Gel and Sample Container(s) were not recorded on UVI 3224872										

The logo for United Vision Logistics features a stylized 'U' icon composed of several small squares, followed by the company name 'United Vision' in a bold, italicized font, with 'LOGISTICS' in a smaller, bold font below it.

**ORDER NUMBER**

**ORDER NUMBER  
4958000**

**WAYBILL NO: 3224872**

SHIPPED FROM:

DATE

**CUSTOMER #**

TERM 4

**CHARGE TO:**

SHIPPED TO

DATE

SHIPPER: X

**SAFETY FROM HEAD TO TOE - PERSONAL PROTECTIVE EQUIPMENT IS A MANDATORY REQUIREMENT**

**The shipper acknowledges and agrees:**

(1) Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property as follows:

"The agreed or declared value of the property is specifically stated by the shipper to be not exceeding \_\_\_\_\_ per \_\_\_\_\_

**10-11-11-A Limitation for loss or damage applies. Unless otherwise specified in a written contract between carrier and shipper, carrier's liability is limited to \$2.50 per pound or**

(2) Liability Limitation for loss or damage applies. Unless otherwise specified in a written contract between carrier and shipper, liability for loss or damage will not exceed \$100,000, whichever is less, as set forth in further detail in Carrier's applicable tariff. Additional levels of Carrier liability are available in exchange for higher transportation charges as provided in Carrier's applicable tariff. See 49 U.S.C. § 14706(c)(1)(A) and (B).

CONSIGNEE / RECEIVED IN GOOD ORDER EXCEPT AS NOTED & APPROVED BY

**SEE REVERSE SIDE OF WAYBILL FOR ADDITIONAL TERMS AND CONDITIONS**

X Pedro 2 b.c.

**signature required**

UVL TRIP REPORT

Diesel  Gasoline

**CUSTOMER FIELD COPY**

## Michele Ellis

**From:** Park, Jeffrey <jeffrey.park@aecom.com>  
**Sent:** Wednesday, April 29, 2020 6:58 AM  
**To:** David Daniel  
**Cc:** Michele Ellis  
**Subject:** TCW-12 CD

Hi Dave.

AECOM Sample ID: JIP Study - [REDACTED] TCW - 12

Critical Effluent Dilution (%): 0.41

### Supporting Information:

Parameter	Unit	Value
Discharge rate <sup>[1]</sup>	bbl/day	7,968
Discharge pipe diameter	inches	15.75
Depth Difference between end of pipe and seafloor	meters	2,031

Notes: [1] Per Operator: Duration of discharge was 90 minutes. Total volume discharged = 498 bbl. Rate (bbl/min.) = 498 bbls/90 minutes = 5.53 bbls/min. The discharge was scaled to bbl/day where: 24 hours/day \* 60 minutes/hour = 1,440 minutes/day; and 5.53 bbls/minute \* 1,440 minutes/day = 7,968 bbls/day.

129

Table 1-E: Critical Dilution (Percent Effluent) for Lower Volume Discharges with a Depth Difference Between the Discharge Pipe and the Sea Floor of Greater than 12 Meters

Discharge Rate (bbl/day)	Pipe Diameter (Inches)					
	>0" to 5"	>5" to 7"	>7" to 9"	>9" to 11"	>11" to 15"	>15"
0 to 500	0.08	0.07	0.05	0.04	0.03	0.03
501 to 1000	0.11	0.13	0.10	0.09	0.07	0.05
1001 to 2000	0.15	0.15	0.21	0.18	0.13	0.10
2001 to 3000	0.17	0.17	0.31	0.26	0.20	0.16
3001 to 4000	0.19	0.19	0.19	0.35	0.27	0.21
4001 to 5000	0.21	0.21	0.21	0.44	0.33	0.26
5001 to 6000	0.23	0.23	0.23	0.23	0.40	0.31
6001 to 7000	0.24	0.24	0.24	0.24	0.47	0.36
7001 to 8000	0.19	0.19	0.19	0.19	0.53	0.41

Jeffrey J. Park  
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Industrial Water and Wastewater  
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[jeffrey.park@aecom.com](mailto:jeffrey.park@aecom.com)

**AECOM**  
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Chelmsford, MA 01824, USA  
[www.aecom.com](http://www.aecom.com)

Built to deliver a better world

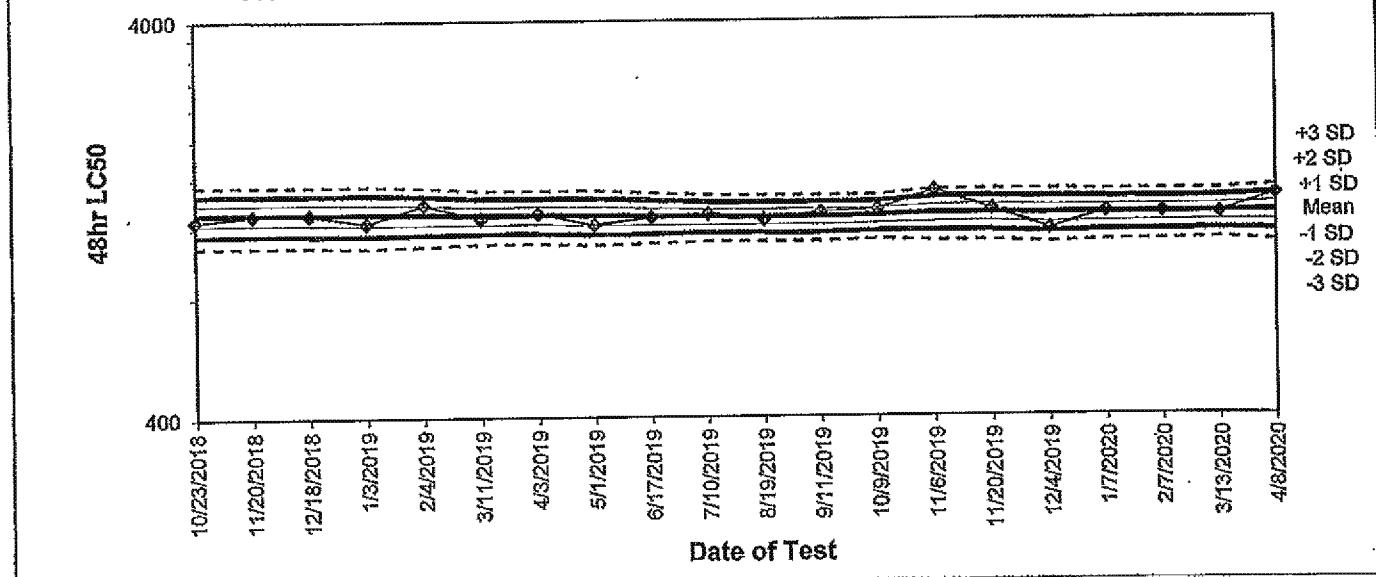
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**Environmental Enterprises USA, Inc.**

## **APPENDIX E**

EPA Method 2006, *M. beryllina* SRT, KCl mg/L

CV% = 5.3



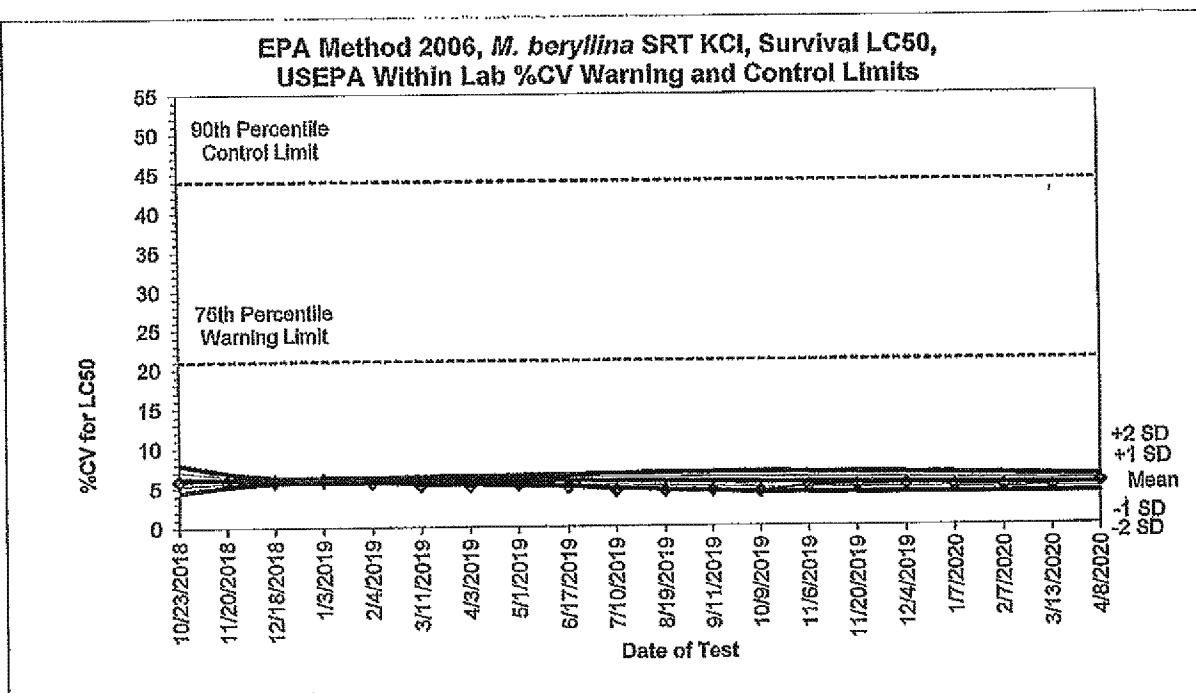
Dilution Series = 480, 686, 980, 1400, 2000 mg/L KCl; Dilution Factor = 0.70

Organism Source	Test #	Test Date	48-hr LC50 mg/L KCl	Cumulative Mean LC50	-1 SD	-2 SD	+1 SD	+2 SD	-3 SD	+3 SD	Control Survival	Toxicant Lot #
EE USA	MN1810-48	10/23/2018	1280	1304	1227	1160	1380	1457	1074	1533	100.0	176734
EE USA	MN1811-48	11/20/2018	1290	1302	1226	1149	1378	1455	1073	1531	100.0	176734
EE USA	MN1812-48	12/18/2018	1292	1302	1225	1149	1378	1455	1072	1531	100.0	176734
EE USA	MN1901-48	1/3/2019	1230	1300	1222	1144	1377	1455	1066	1533	100.0	177483
EE USA	MN1902-48	2/4/2019	1370	1297	1223	1149	1370	1444	1076	1518	100.0	177483
EE USA	MN1903-48	3/11/2019	1261	1288	1221	1164	1355	1422	1087	1489	100.0	177483
EE USA	MN1904-48	4/3/2019	1300	1290	1224	1157	1357	1423	1090	1490	100.0	177483
EE USA	MN1905-48	5/1/2019	1213	1284	1216	1148	1351	1419	1081	1487	100.0	177483
EE USA	MN1906-48	6/17/2019	1267	1278	1215	1162	1341	1404	1089	1466	100.0	177483
EE USA	MN1907-48	7/10/2019	1292	1273	1215	1158	1330	1387	1101	1445	100.0	177483
EE USA	MN1908-48	8/19/2019	1247	1270	1213	1156	1326	1383	1099	1440	100.0	C799290
EE USA	MN1909-48	9/11/2019	1300	1269	1213	1156	1326	1382	1100	1439	100.0	C799290
EE USA	MN1910-48	10/9/2019	1320	1275	1220	1165	1330	1385	1110	1441	100.0	C799290
EE USA	MN1911-48	11/6/2019	1477	1291	1228	1164	1365	1419	1100	1483	100.0	C799290
EE USA	MN1912-48	11/20/2019	1319	1293	1229	1165	1357	1421	1100	1485	100.0	C799290
EE USA	MN1913-48	12/4/2019	1174	1283	1217	1151	1349	1418	1085	1481	100.0	C799290
EE USA	MN2001-48	1/7/2020	1296	1287	1224	1161	1350	1414	1098	1477	100.0	C799290
EE USA	MN2002-48	2/7/2020	1290	1286	1223	1161	1349	1411	1098	1474	100.0	181155
EE USA	MN2003-48	3/13/2020	1282	1289	1227	1166	1350	1411	1105	1472	100.0	181155
EE USA	MN2004-48	4/8/2020	1430	1295	1226	1157	1364	1433	1088	1502	100.0	181155

MN1911-48 - One out of twenty points exceeded 2 SD but is within 3 SD. According to EPA 821-R-02-012 section 4.15.4 at the P0.05 probability level this is expected to occur by chance alone. Conduct another test. EE USA's control limits are very narrow. The %CV is 4.9; which is well within the 10th percentile (%CV = 7) of CVs reported nationally for SRT testing. Laboratory performance is acceptable.

QAQC by: MWD 4/14/20

**EPA Method 2006, *M. beryllina* SRT KCl, Survival LC50,  
USEPA Within Lab %CV Warning and Control Limits**

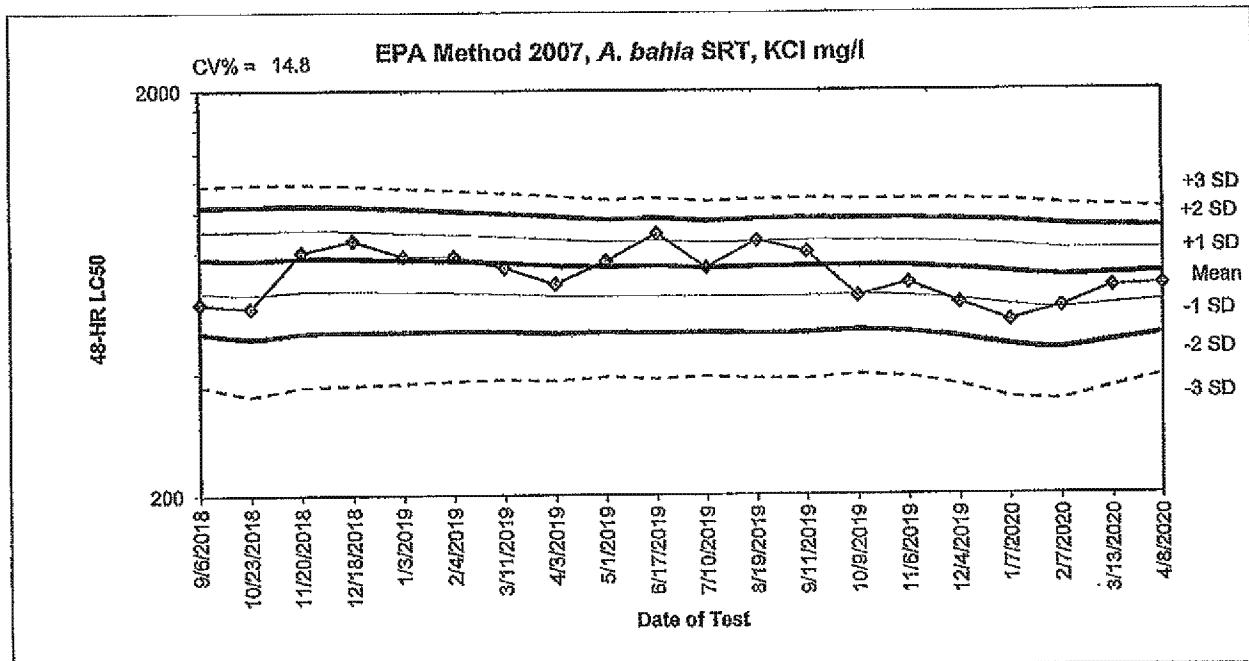


7%CV = 10th percentile, 15%CV = 25th percentile, 16%CV = 50th percentile. CV percentile values from Appendix B-7, Table B-2 of EPA's

"Understanding and Accounting for Method Variability in WET Applications Under the NPDES Program", June 30, 2000.

Test #	Test Date	%CV for LC50	Mean %CV	-1 SD	-2 SD	+1 SD	+2 SD	75th Warning Limit	90th Control Limit	SRT Lot #
MN1810-48	10/23/2018	5.9	6.2	5.4	4.5	7.1	8.0	21.0	44.0	176734
MN1811-48	11/20/2018	5.9	6.1	5.6	5.2	6.5	6.9	21.0	44.0	176734
MN1812-48	12/18/2018	5.9	6.0	5.8	5.6	6.1	6.3	21.0	44.0	176734
MN1901-48	1/3/2019	6.0	6.0	5.8	5.6	6.1	6.3	21.0	44.0	177483
MN1902-48	2/4/2019	5.7	6.0	5.8	5.7	6.1	6.2	21.0	44.0	177483
MN1903-48	3/11/2019	5.2	5.9	5.7	5.5	6.1	6.4	21.0	44.0	177483
MN1904-48	4/3/2019	5.2	5.9	5.6	5.3	6.2	6.4	21.0	44.0	177483
MN1905-48	5/1/2019	5.3	5.9	5.5	5.2	6.2	6.5	21.0	44.0	177483
MN1906-48	6/17/2019	4.9	5.8	5.4	5.1	6.2	6.5	21.0	44.0	177483
MN1907-48	7/10/2019	4.5	5.7	5.3	4.8	6.2	6.7	21.0	44.0	C799290
MN1908-48	8/19/2019	4.5	5.6	5.1	4.6	6.2	6.7	21.0	44.0	C799290
MN1909-48	9/11/2019	4.5	5.6	5.0	4.4	6.2	6.8	21.0	44.0	C799290
MN1910-48	10/9/2019	4.3	5.5	4.8	4.2	6.2	6.8	21.0	44.0	C799290
MN1911-48	11/6/2019	4.9	5.4	4.8	4.1	6.1	6.7	21.0	44.0	C799290
MN1912-48	11/20/2019	5.0	5.4	4.7	4.1	6.0	6.7	21.0	44.0	C799290
MN1913-48	12/4/2019	5.1	5.4	4.7	4.1	6.0	6.6	21.0	44.0	C799290
MN2001-48	1/7/2020	4.9	5.3	4.7	4.1	5.9	6.5	21.0	44.0	181155
MN2002-48	2/7/2020	4.9	5.2	4.6	4.1	5.8	6.4	21.0	44.0	181155
MN2003-48	3/13/2020	4.8	5.2	4.6	4.1	5.7	6.2	21.0	44.0	181155
MN2004-48	4/8/2020	5.3	5.1	4.6	4.1	5.6	6.2	21.0	44.0	181155

QAQC by: MMO 4/14/20



Dilution Series = 150, 250, 416, 694, 1157 mg/L KCl; Dilution Factor = 0.60

Organism Source	Test #	Test Date	48-hr LC50 mg/L KCl	Cum. Mean LC50	-1 SD	-2 SD	+1 SD	+2 SD	-3 SD	+3 SD	Control Survival	Toxicant Lot #
EE USA	AB1810-48	9/6/2018	695	769	637	505	901	1034	373	1166	100.0	176734
EE USA	AB1811-48	10/23/2018	580	764	627	489	902	1039	352	1177	100.0	176734
EE USA	AB1812-48	11/20/2018	799	773	638	504	907	1041	370	1175	100.0	176734
EE USA	AB1813-48	12/18/2018	851	770	638	506	903	1035	373	1167	100.0	176734
EE USA	AB1901-48	1/3/2019	779	765	636	507	893	1022	378	1151	100.0	177483
EE USA	AB1902-48	2/4/2019	779	759	633	508	884	1009	383	1135	100.0	177483
EE USA	AB1903-48	3/11/2019	730	751	629	507	873	994	386	1116	100.0	177483
EE USA	AB1904-48	4/3/2019	666	740	621	502	859	977	383	1096	100.0	177483
EE USA	AB1905-48	5/1/2019	759	734	620	506	848	961	392	1075	100.0	177483
EE USA	AB1906-48	6/17/2019	885	735	619	503	851	967	387	1083	100.0	177483
EE USA	AB1907-48	7/10/2019	730	729	617	504	841	953	392	1065	100.0	177483
EE USA	AB1908-48	8/19/2019	861	733	618	502	848	963	387	1078	100.0	C799290
EE USA	AB1909-48	9/11/2019	799	735	619	503	851	967	387	1083	100.0	C799290
EE USA	AB1910-48	10/9/2019	618	737	624	510	851	964	396	1078	100.0	C799290
EE USA	AB1911-48	11/6/2019	668	734	620	505	849	963	390	1078	100.0	C799290
EE USA	AB1912-48	12/4/2019	595	723	606	489	840	957	372	1073	100.0	C799290
EE USA	AB2001-48	1/7/2020	537	708	587	467	828	949	347	1069	100.0	C799290
EE USA	AB2002-48	2/7/2020	580	693	576	459	810	927	342	1044	100.0	181155
EE USA	AB2003-48	3/13/2020	651	699	589	478	810	921	368	1031	100.0	181155
EE USA	AB2004-48	4/8/2020	658	706	601	497	810	914	392	1019	100.0	181155

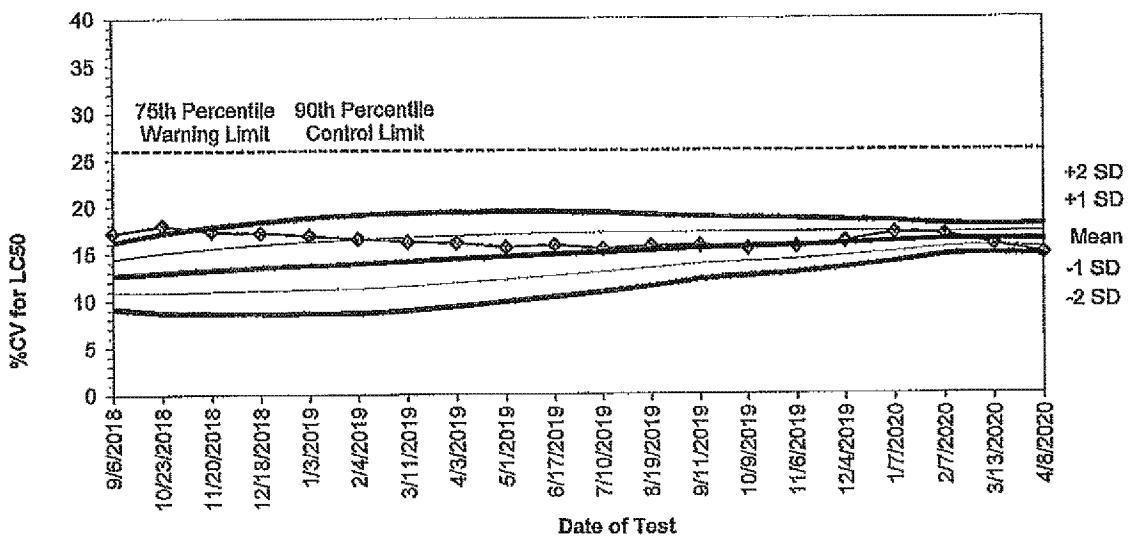
AB1811-48 - Four out of five consecutive points outside -1 SD that may indicate the start of a trend and shift in test organism sensitivity.

The %CV is 18.0, which is within the 50th percentile of CVs reported nationally for SRT testing. Test method performance is acceptable.

AB2004-48 - There is a trend of seven points on one side of the mean with a decrease in test organism robustness. Intralaboratory precision (%CV = 14.8) is at USEPA's 10th percentile for intralaboratory CVs reported nationally (%CV ≈ 17). Ongoing laboratory performance is acceptable.

QAQC by: MWD 4/14/20

**EPA Method 2007, *A. bahia* SRT KCl, Survival LC50,  
USEPA Within Lab %CV Warning and Control Limits**



17%CV = 10th percentile, 17%CV = 25th percentile, 25%CV = 50th percentile. CV percentile values from Appendix B-7, Table B-1 of EPA's "Understanding and Accounting for Method Variability in WET Applications Under the NPDES Program", June 30, 2000.

Test #	Test Date	%CV for LC50	Mean %CV	-1 SD	-2 SD	+1 SD	+2 SD	75th Warning Limit	90th Control Limit	SRT Lot #
AB1810-48	9/6/2018	17.2	12.7	10.9	9.2	14.5	16.2	26.0	26.0	176734
AB1811-48	10/23/2018	18.0	13.0	10.9	8.7	15.1	17.2	26.0	26.0	176734
AB1812-48	11/20/2018	17.4	13.3	11.0	8.7	15.6	17.9	26.0	26.0	176734
AB1813-48	12/18/2018	17.2	13.5	11.1	8.6	16.0	18.4	26.0	26.0	176734
AB1901-48	1/3/2019	16.9	13.7	11.2	8.6	16.3	18.8	26.0	26.0	177483
AB1902-48	2/4/2019	16.5	13.9	11.3	8.7	16.5	19.1	26.0	26.0	177483
AB1903-48	3/11/2019	16.2	14.1	11.5	9.0	16.7	19.3	26.0	26.0	177483
AB1904-48	4/3/2019	16.1	14.4	11.9	9.4	16.9	19.4	26.0	26.0	177483
AB1905-48	5/1/2019	15.5	14.6	12.2	9.8	17.0	19.4	26.0	26.0	177483
AB1906-48	6/17/2019	15.8	14.8	12.6	10.3	17.1	19.4	26.0	26.0	177483
AB1907-48	7/10/2019	15.4	15.0	12.9	10.8	17.2	19.3	26.0	26.0	177483
AB1908-48	8/19/2019	15.7	15.3	13.4	11.5	17.2	19.1	26.0	26.0	C799290
AB1909-48	9/11/2019	15.8	15.5	13.8	12.2	17.2	18.8	26.0	26.0	C799290
AB1910-48	10/9/2019	15.4	15.6	14.1	12.5	17.2	18.7	26.0	26.0	C799290
AB1911-48	11/6/2019	15.6	15.7	14.3	12.9	17.2	18.6	26.0	26.0	C799290
AB1912-48	12/4/2019	16.2	15.9	14.6	13.4	17.2	18.5	26.0	26.0	C799290
AB2001-48	1/7/2020	17.0	16.1	15.0	13.9	17.2	18.3	26.0	26.0	C799290
AB2002-48	2/7/2020	16.9	16.3	15.6	14.7	17.1	17.9	26.0	26.0	181165
AB2003-48	3/13/2020	15.8	16.4	15.6	14.9	17.1	17.8	26.0	26.0	181165
AB2004-48	4/8/2020	14.8	16.3	15.4	14.6	17.1	17.9	26.0	26.0	181165

QAQC by: MTO 4/4/20